Technology Evaluation Workplan (Smart Sonic)

4/23/98

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A. **PROJECT MANAGEMENT**

1. TITLE AND APPROVAL SHEET

Department of Toxic Substances Control

Mr. Tony Luan
Assignment Manager

_____

Mr. John Wesnousky
Technical Review Panel

_____

Mr. Pat Bennett
Technical Project Manager

_____

Dr. Wolfgang Fuhs
Technical Review Panel

_____

US Environmental Protection Agency

Ms. Norma Lewis
Technical Project Manager

_____

Mr. Sam Hayes
Quality Assurance Officer

_____

2. DISTRIBUTION LIST

Mr. Tony Luan, DTSC/OPPTD (Primary Decision Maker)
Dr. Bruce Labelle, DTSC/OPPTD (QA/QC Reviewer)
Mr. Leon Woods, DTSC/OPPTD (Health and Safety Reviewer)
Toxicologist (TBD), DTSC/HERD (Toxicology Reviewer)
Dr. Bart Simmons, DTSC/HML (Lab Service Provider)
Mr. Phil Loder, DTSC/OPPTD (Project Reviewer)
Mr. Dick Jones, DTSC/OPPTD (Project Reviewer)

Ms. Norma Lewis, US EPA (Technical Project Manager)
Sam Hayes, US EPA (QA/QC Officer)
Mr. Gregory J. Carroll, US EPA (Project Reviewer)
Ms. Penelope Hansen, US EPA (Project Reviewer)

Mr. Bill Schreiber, President, Smart Sonic Corporation

3. PROJECT/TASK ORGANIZATION (see Figure 1)

Department of Toxic Substances Control

Assignment Manager- Tony Luan has final DTSC authority and oversight of planning team's activities.

Project Manager - Pat Bennett is responsible for overseeing implementation of the Technology Evaluation Workplan, coordinating project team meetings, ensuring that necessary resources are provided for planning team decisions, and for preparing project reports.

QA/QC Member- Bruce Labelle is responsible for ensuring the data collection system meets QA/QC requirements.

Toxicologist - Toxicologist (TBD) is responsible for identifying toxic constituents that may pose a threat to public health and the environment.

Industrial Hygienist - Leon Woods is responsible for ensuring worker health and safety.

Laboratory Activities - Bart Simmons is Chief of DTSC's Hazardous Materials Laboratory and is responsible for overseeing laboratory QA/QC procedures.

Planning Team Members - All team members are responsible for participating field activities, project meetings and reviewing project reports. Each member of the project team was selected based on knowledge and experience of aqueous cleaners.

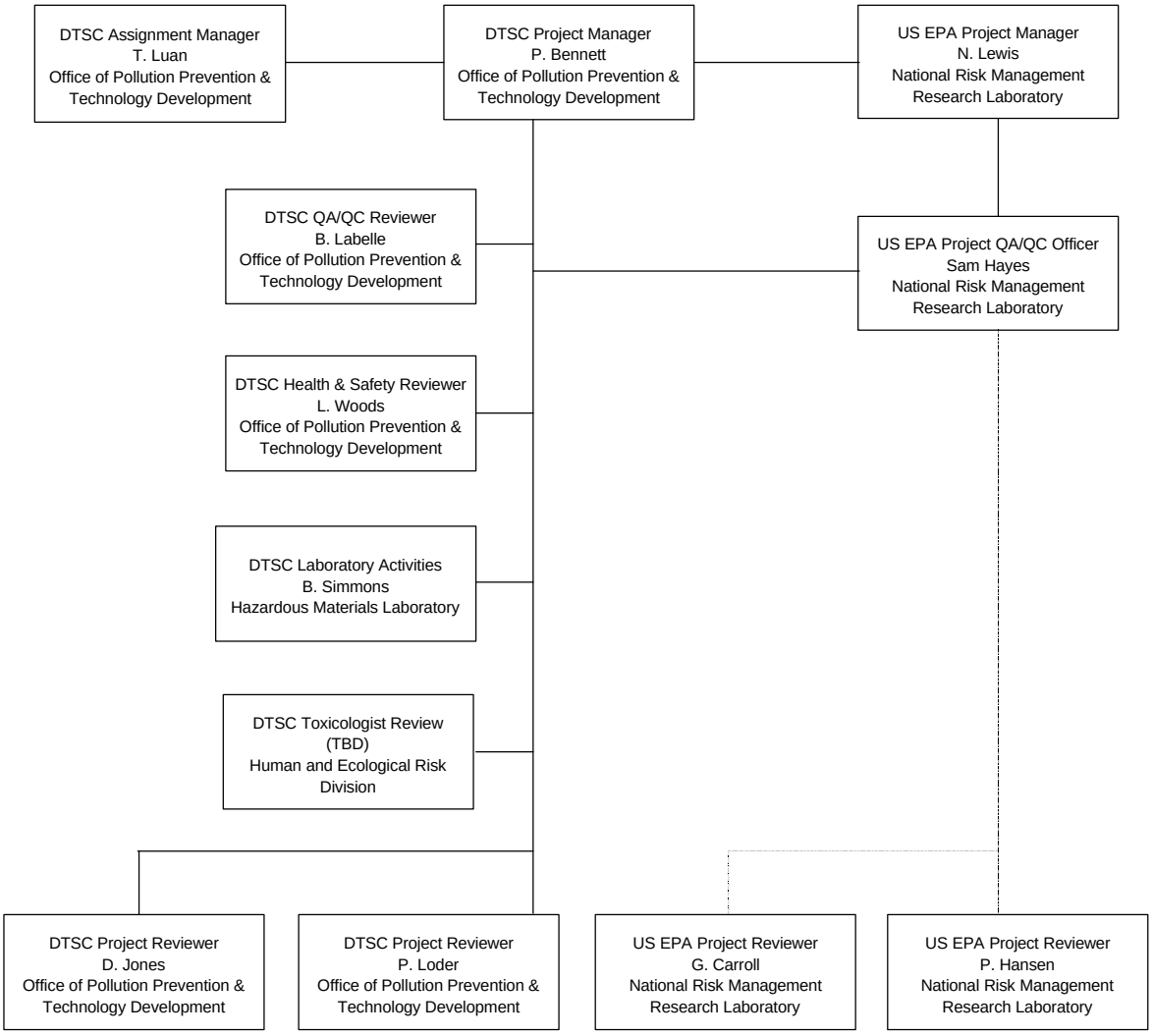
US Environmental Protection Agency

Project Manager - Norma Lewis is responsible for providing US EPA oversight and review of the Technology Evaluation Workplan, workplan implementation and data evaluation reports.

QA/QC - Sam Hayes is responsible for providing US EPA QA/QC review of the QAPP and data analysis.

Project Reviewers - US EPA project team members are responsible for reviewing DTSC project team activities and reports.

Figure 1. Project Organization Chart



4. PROBLEM DEFINITION/BACKGROUND

Stencils are used in the printed circuit board industry to apply a solder paste pattern onto surface mounted circuit boards. Electronic components are then mounted to the circuit board in the solder paste areas. Following the assembly of components, the circuit board is processed in the reflow oven in which the solder melts and forms the solder joint. After the printing process, the stencil is cleaned to remove solder paste residual and stored for a future print run. It is important to clean the stencil thoroughly so as to not cause misprints in future print runs.

Problem Background

Solvents used to clean solder paste from printed circuit board stencils included CFC-113, 1,1,1-TCA and IPA. The chlorinated solvents, CFC-113 and 1,1,1-TCA, are in limited use today due to its production ban as of January 1, 1996 (Title VI of the Clean Air Act Amendments). The reason for the production ban was that these solvents contribute to stratospheric ozone depletion and global warming. Stockpiled chlorinated solvents are still used to a small extent (<5%, Smart Sonic estimate based on customer usage).

Following the production ban of CFC-113 and 1,1,1-TCA, businesses began switching to alternative solvents such as IPA. The problem with IPA is that it contributes to tropospheric smog and therefore is considered a Volatile Organic Compound (VOC). Table 1 identifies the technical and environmental characteristics of the above solvents.

Table 1. Technical and Environmental Characteristics
(reference: Alternatives to Chlorinated Solvents in Cleaning Applications, 12/94)

	PEL (ppm)	VOC	Flash Point (°F)	ODP	GWP	TOX[a]
CFC-113	1000	No	No	0.8	1.4	---
1,1,1-TCA	350	No	No	.1	.026	---
IPA	400	Yes	72	---	---	IT

[a] IT - in testing

Acronyms:

PEL- Permissible Exposure Limit
VOC - Volatile Organic Compound
ODP - Ozone Depletion Potential
GWP - Global Warming Potential

Problem Definition

Use of CFC-113, 1,1,1-TCA, and IPA in the cleaning of printed circuit board stencils contributes to photochemical smog, ozone depletion, global warming and poses a potential threat to worker health and safety.

Problem Resolution

Smart Sonic Corporation developed an ultrasonic aqueous cleaning system to replace CFC-113, 1,1,1-TCA, and IPA-based systems for removing solder paste from printed circuit boards stencils. Smart Sonic claims that its ultrasonic aqueous cleaning systems, Model 2000 and Model 4200 (systems information is enclosed in Appendix A), contains non-detectable VOC or halogenated compounds. Smart Sonic also claims that its cleaning systems can remove solder paste from printed circuit board stencils such that no solder paste is visible in stencil apertures under 10X magnification. There are currently no cleanliness standards in the industry regarding PCB stencils. The draft claims are found in Appendix B.

5. PROJECT/TASK DESCRIPTION

The project objectives are to validate the technology claims (enclosed in Appendix B) proposed by Smart Sonic, to identify any unknown potential hazards to the public and the environment from use of this technology, and to acquire other technology performance information relevant to this evaluation.

There are two measurements required to validate Smart Sonic's claims; laboratory analysis of Smart Sonic's 440-R Detergent and performance evaluation of Smart Sonic's cleaning systems. Laboratory analysis are required to determine whether Smart Sonic's 440-R Detergent contains detectable VOCs or halogenated compounds. California's South Coast Air Quality Management District (SCAQMD) has an existing program in place to analyze aqueous cleaners for the presence of VOCs and halogenated compounds (Appendix C - "Clean Air Solvent (CAS) Certification Protocols" dated April 1997). The CAS Certification Protocols requires SCAQMD to analyze aqueous cleaners using the most recent version of their Test Method 313 "Determination of Volatile Organic Compounds (VOC) by Gas Chromatography/Mass Spectrometry (GC/MS)". The compounds specifically tested for are listed in the appendices of SCAQMD CAS Certification Protocol and include volatile organic hazardous air pollutants (VOHAP), ozone depleting compounds (ODC), global warming compounds (GWC), and other VOCs that have maximum incremental reactivities (MIR) greater than toluene. If SCAQMD's Test Method 313 detects any VOHAPs, ODCs. GWCs, or has a VOC component with MIR greater than toluene then the cleaner will not be certified. If the cleaner contains VOC components with MIR values less than toluene, the VOC components are quantitated. If total VOCs is greater than 50 grams/liter, at working strength solution, the cleaner will not be certified. If a cleaner passes SCAQMD's requirements, the vendor of the cleaner will receive a CAS Certificate.

Smart Sonic has submitted a sample of its 440-R Detergent to SCAQMD and was issued a CAS Certificate by SCAQMD on October 16, 1997 (Appendix D). The Project Team will validate SCAQMD laboratory results (Appendix D), ensure data quality control and data quality assurance, and determine if further laboratory data is required. For additional quality assurance, two additional samples of Smart Sonic's 440-R Detergent (different batch numbers) will be collected from Smart Sonic's end-users and sent to the SCAQMD lab for testing. Again, the Project team will review laboratory data for completeness. Alternative actions to be taken by the Project Team are based on whether VOCs and halogenated compounds are detected at or above SCAQMD laboratory detection limits of 100 ppm or .01%.

The cleanliness performance claim will be validated through on-site observations and in some cases supported through telephone surveys. Telephone and on-site surveys developed by the Project Team are shown in Appendix F. In validating the cleanliness claim, alternative action will be taken if on-site observations reveal that solder paste exists in printed circuit board apertures, after cleaning, under 10X magnification.

Tests and reviews will be conducted to ensure no other potential hazards to public health or the environment are present. These include US EPA Test Method 6010 to scan for metals and US EPA Test Method 9041 for pH measurement. In addition to the metals identified in Test Method 6010, the Project Manager will also request that mercury be tested for. According to a fact sheet prepared by Michigan State's Environmental Assistance Center (Appendix E), caustic soda solutions found in some aqueous cleaners may contain mercury. Two samples of Smart Sonic's 440-R detergent will be tested for metals and pH. Alternative actions to be taken by the Project Team are based on whether hazards exist and controls are in place to minimize or mitigate hazards.

Additional performance data will also be collected through telephone surveys and on-site visits. This data will provide additional support to the technology's performance evaluation and may identify issues that merit further evaluation. Such information will provide potential users with a range of technology performance parameters (i.e., equipment operating parameters, waste generation rates, waste characteristics, and waste management methods). Comments received by the operators during surveys and on-site visits will be qualitatively assessed by the project team, the US EPA Project Manager and Quality Assurance Officer.

A workplan outline identifying the activities required to evaluate Smart Sonic's technology is shown in Figure 2. Four main activities include laboratory testing, toxicologist and industrial hygienist review, end-user surveys, and end user on-site observations and inspections. Following these activities, the project team members will meet, discuss data results, and/or identify additional data needs. DTSC's Project Manager will prepare evaluation summaries following each major activity in the workplan outline. Evaluation summaries will include all supporting lab and survey data, and reviews. Section 7 identifies the supporting documentation and records required for the Project Team's evaluation.

A schedule for implementing the workplan is shown in Figure 3.

6. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT

The project objectives are to validate the claims (enclosed in Appendix B) proposed by Smart Sonic, to identify any unknown potential hazards to the public and the environment, and to acquire other technology performance information relevant to this evaluation. All project objectives are considered of similar importance to the evaluation of this project. As shown in Figures 4, 5, 6, and 7, there are no definite pass/fail criteria for certifying/verifying this project. The implications of all negative decisions are similar which include alternative actions that could be taken to continue the project, i.e., discuss results with project team and Smart Sonic to modify claims and/or change operational procedures.

Figures 4 and 5 are flowcharts of the data needs and decisions required to validate the claims proposed by Smart Sonic. As shown in Figure 4, alternative action will be taken if VOCs or halogenated compounds are detected using SCAQMD's most recent version of their Test Method 313 "Determination of Volatile Organic Compounds (VOC) by Gas Chromatography/Mass Spectrometry (GC/MS)" (Appendix C). The detection limit using Test Method 313 is 0.01% or 100 ppm. This detection limit was determined by the Project Team as acceptable for decision making for several reasons:

- VOC compound(s) below 0.01% or 100 ppm will be diluted 10 fold to working strength and will most likely not be of a health or safety concern;
- cleaning bath is operated at room temperature and therefore release of volatiles is unlikely or minimal;
- detergent has a tendency to hold VOCs in solution; and
- detection limit of .01% is more than adequate when compared to the high levels of VOCs and halogenated compounds in previously used solvents such as CFC-113, 1,1,1-TCA, and IPA.

As stated in section A6, SCAQMD will certify cleaners that contain less than 50 g/l of VOCs (at working strength solution). Smart Sonic's claim for this evaluation, however, states that its cleaner does not contain <u>any detected</u> VOCs or halogenated compounds. Technically, Smart Sonic may meet SCAQMD's CAS requirements, but may not meet the proposed claims for this evaluation. After review of SCAQMD laboratory data, the Project Team will take alternative action if <u>any</u> VOCs or halogenated compounds are detected at .01% or 100 ppm using SCAQMD Test Method 313. The alternative action will consist of identifying and quantifying (estimate) detected VOCs or halogenated compounds and discussing with Smart Sonic what further action will be taken such as modifying the certification/verification claims to identify a VOC threshold, or discontinuing the project.

As shown in Figure 5, alternative action will be taken if Smart Sonic's Ultrasonic Aqueous Cleaning Systems are not able to remove solder paste from PCB stencils such that no solder paste remains in stencil apertures using 10X magnification. This decision will be made based on on-site observations and inspections (using 10X magnification eye-glass) conducted by the project manager and one member from the project team. Additional cleanliness standard validation may be supported through telephone surveys.

As shown in Figure 6, the project team's industrial hygienist and toxicologist will verify that no other characteristics or conditions exist which may pose a hazard to public health and the environment. The toxicologist determination will be based on review of Smart Sonic's aqueous cleaner detergent list, chemical abstract summaries, material safety data sheets provided by Smart Sonic's detergent blender, and laboratory data (from metals scan, pH measurement, and SCAQMD Test Method 313). Industrial hygienist determination will be based on review of material safety data sheets, users manual, on-site observations and interviews with end-users, and any other data deemed necessary for IH determination. If hazardous characteristics or conditions exist, a review will be conducted to ensure that administrative or engineering controls are in place to eliminate hazards to public safety or the environment. This activity will consist of reviewing the users operations manual, MSDS, and on-site visits and interviews with end-users.

As shown in Figure 7, the project team will collect additional performance data from end-users through telephone surveys and on-site visits and identify any issues which merit further evaluation. Such issues may include the characterization of the spent cleaning baths, effects of cleaning on stencil integrity, regulatory requirements for waste management, or any other issues deemed important by the operator and/or project team members.

Figure 2. Work Plan Outline for Smart Sonic Certification/Verification Project

1. Perform Lab Tests on 440-R SMT Detergent®
   - Method 313-91 of SCAQMD's Clean Air Solvent Certification Protocol
     - SCAQMD analyze 440-R SMT Detergent samples from end-users
     - Obtain and review lab results from previous sample submitted by Smart Sonic and samples from end-users - (Project Team)
   - US EPA Test Method 6010 & 7470 for Metals Analysis (HML)
     - DTSC HML analyze 440-R SMT Detergent samples from end-users
   - US EPA Test Method 9041 for pH measurement (HML)
     - DTSC HML analyze 440-R SMT Detergent samples from end-users
   - Prepare summary of results - (DTSC Project Manager)

2. Toxicologist / Industrial Hygienist Review
   - Review MSDSs, chemical abstract summaries, and laboratory data - (DTSC Toxicologist)
   - Review operations manual, MSDSs, and conduct on-site health and safety observation - (DTSC Industrial Hygienist)
   - Prepare summary of findings - (DTSC Project Manager)

3. Conduct Telephone Survey
   - Acquire up-to-date customer information - (Smart Sonic)
     - facility, address, contact, phone number, model number, chemistry, unit sold date
   - Prepare telephone survey to gather user information. Questions similar to preliminary survey already conducted which includes: - (Project Team)
     - type of business (i.e., R&D, production)
     - type of solder paste used (i.e., no-clean, RMA, and water washable)?
     - stencil size and type?
     - frequent use of cleaning unit and total time in operation?
     - waste management methods?
     - willingness for DTSC on-site visit and further data collection?
   - Conduct telephone survey - (Project Team)
   - Prepare summary of findings - (DTSC Project Manager)

4. Conduct On-Site Visits of Smart Sonic's Customers
   - Select Smart Sonic users for on-site visits.
     - develop selection criteria - (Project Team)
     - review survey data - (Project Team)
     - select companies and schedule on-site visits - (Project Team)
   - Identify additional data needs for on-site visits - (Project Team)
   - Conduct on-site visits - (DTSC Project Manager and one/two members from Project Team)
     - observe cleaning operation
     - observe health and safety practices
     - inspect stencil under 10X magnification
     - gather additional data
   - Prepare summary of findings - (DTSC Project Manager)

5. QA/QC Review of Procedures and Data - (QA/QC Project Team members)

6. Identify Outstanding Issues, Recommend Further Actions, and Resolutions - (Project Team and Smart Sonic)

7. Draft Project Evaluation Report - (DTSC Project Manager)

Figure 3. Smart Sonic's Technology Certification/Verification Schedule

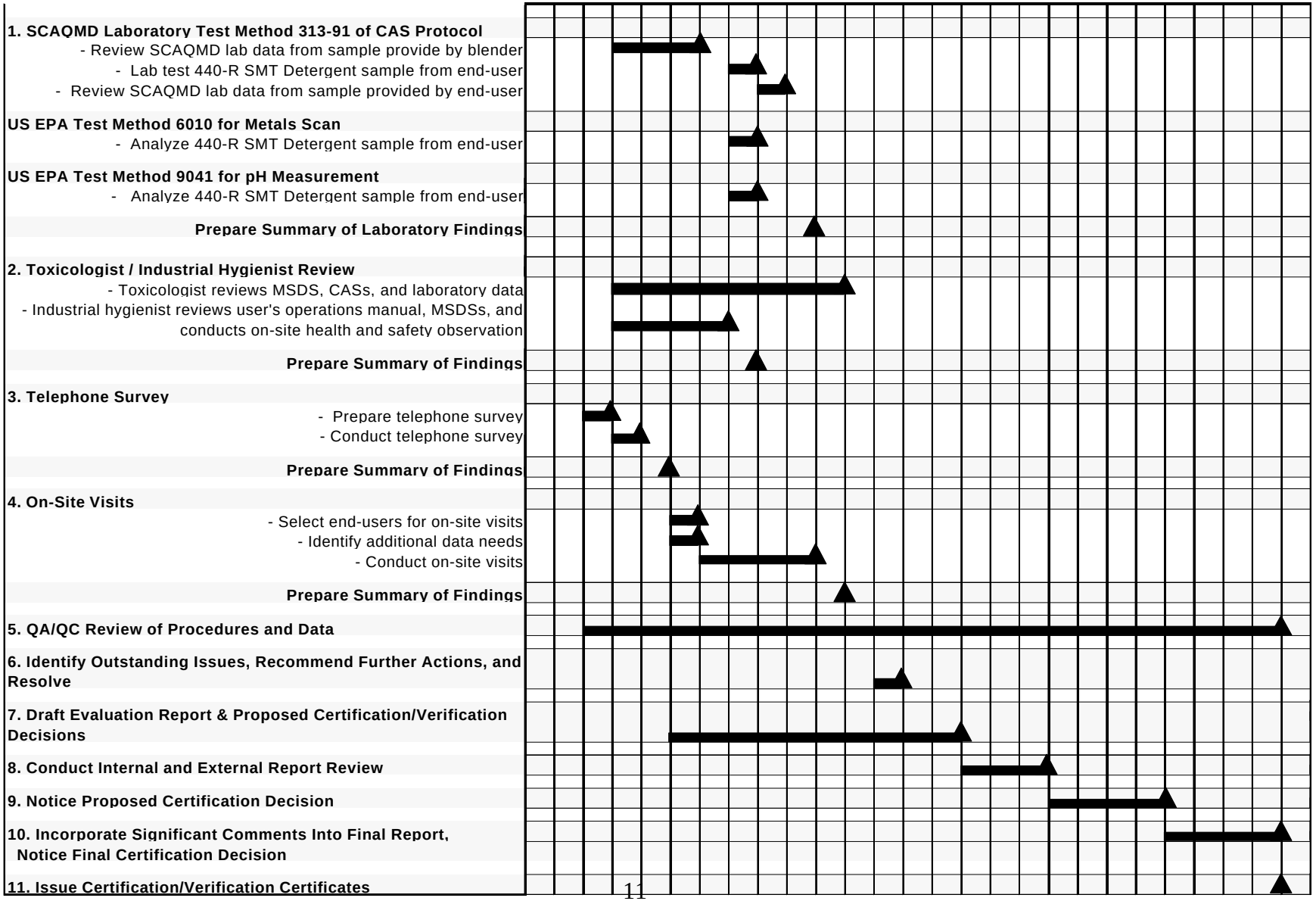


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Figure 4. Multiple Decision Flowchart #1

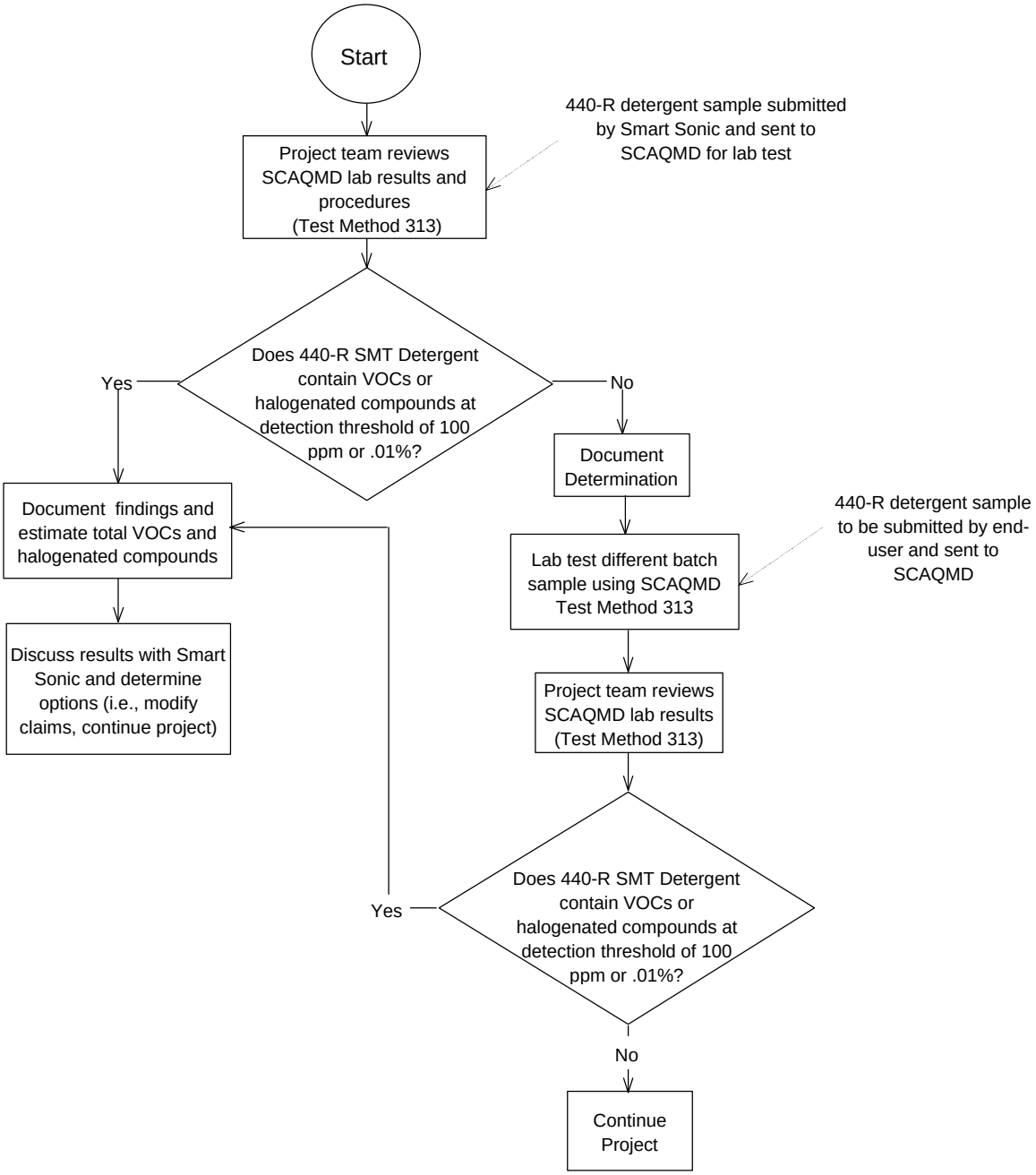


Figure 5. Multiple Decision Flowchart #2

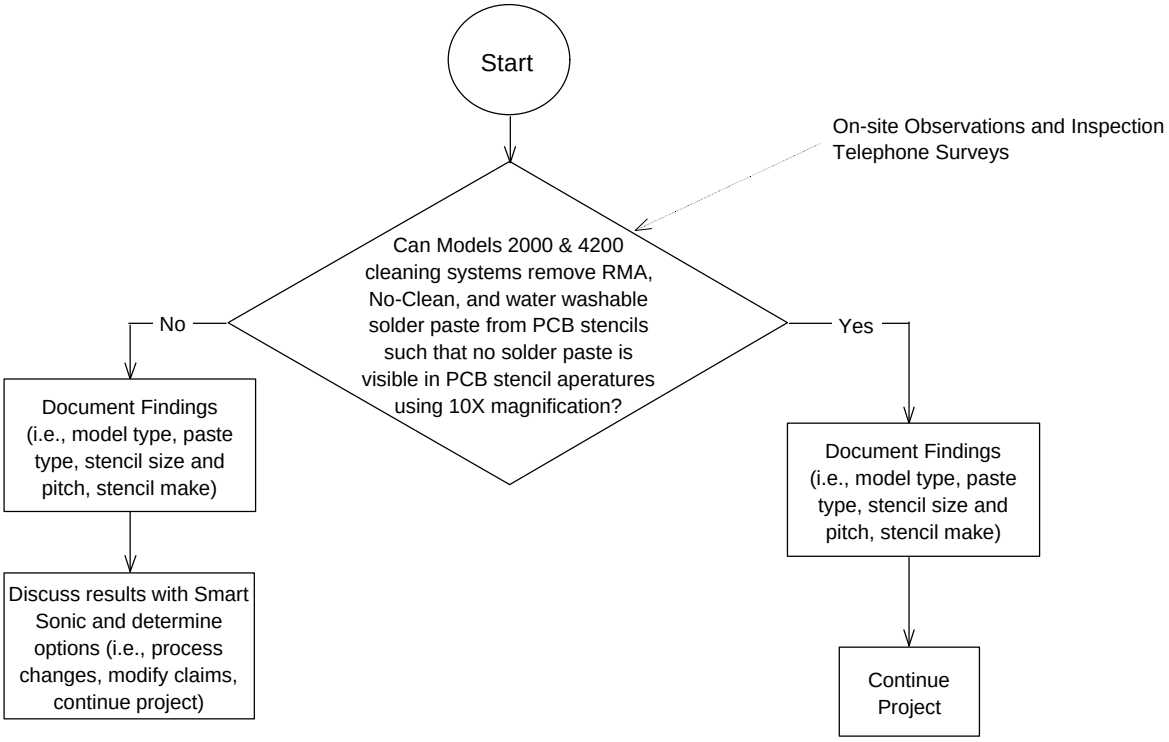


Figure 6. Multiple Decision Flowchart #3

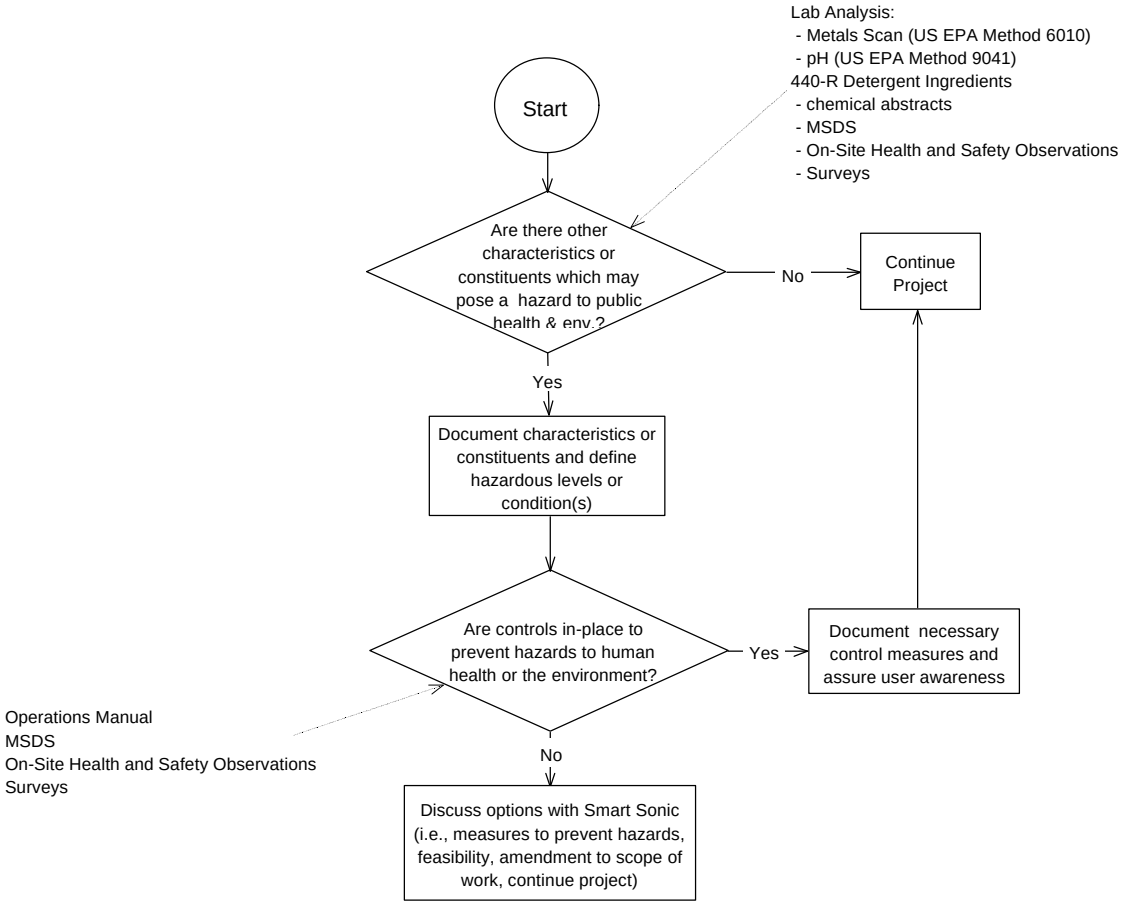
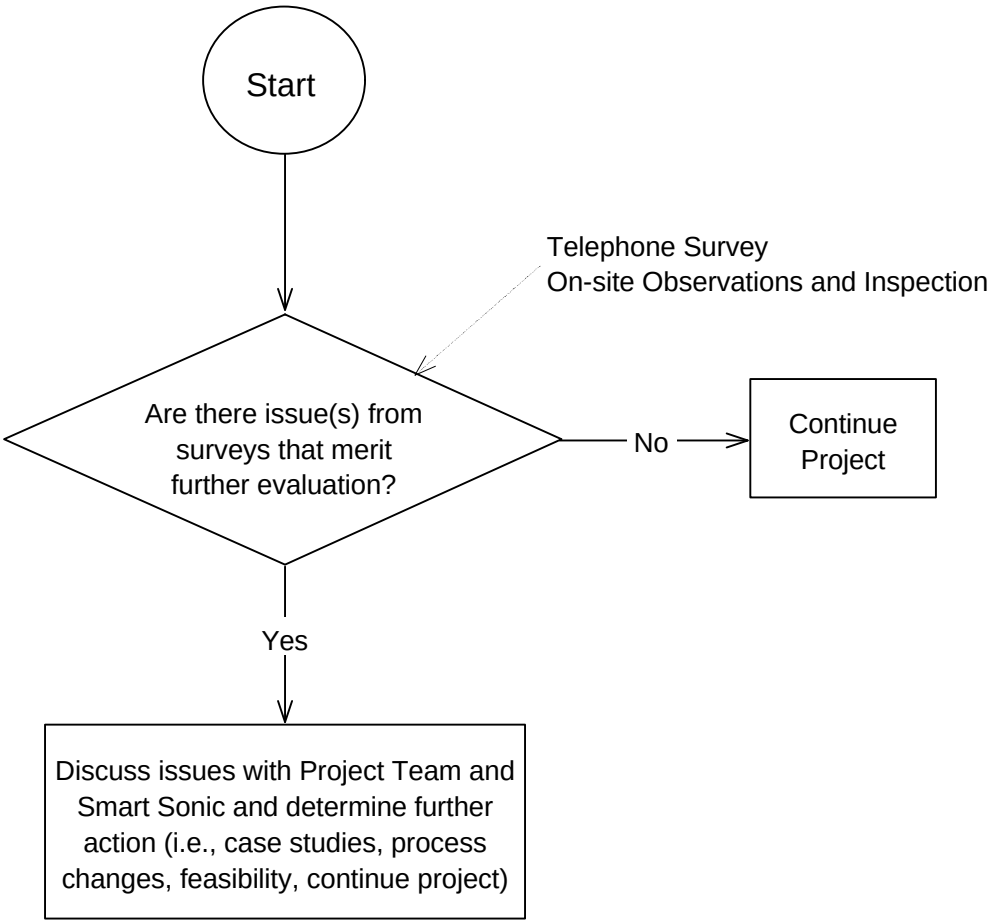


Figure 7. Multiple Decision Flowchart #4



7. DOCUMENTATION AND RECORDS

There are three data records that are important to the assessment of this project which include:

- laboratory data provided by SCAQMD and DTSC's Hazardous Materials Lab (HML);
- telephone and on-site surveys of Smart Sonic end-users; and
- toxicologist and health and safety reports.

The laboratory data packages will consist of records documenting the sampling, transporting, chain-of-custody, storing, testing, recording and analysis of data.

The following is DTSC HML's laboratory data control practices (Appendix G):

- Requestor completes Authorization Request Form. This form is used to identify type of lab tests needed and assigns Laboratory Authorization Number.
- Requestor, at time of sample collection, completes Hazardous Materials Sample Analysis Request. This form documents when and where sample was collected, sample container type and size, what analysis are required, and provides for chain-of-custody. The Laboratory Authorization Number is also identified on the this form. Sample labeling is also required.
- HML receives and logs in sample (internal tracking system). A chemist is then assigned and logs out sample upon time of testing.
- Upon evaluation, a laboratory data package is generated which includes the following documentation:
  - Laboratory Analytical Report
  - Laboratory Quality Control Report
  - Sample Analysis Request Form
  - Internal Sample Tracking Form
  - Raw Data
  - Sample Preparation Form
  - Standard Preparation Form
  - Notes from Laboratory Notebook
  - Instrument Analysis Log
- Laboratory data package is copied and sent to the requestor. Original laboratory data package is archived indefinitely both in hard and electronic copy at HML.
- Requestor completes Sample Disposal Form upon completion of project.

The following is SCAQMD's laboratory data control practices (Appendix H):

- Requestor completes Analysis Request/Chain of Custody (ARCOC) Form. This form documents when and where sample was collected, and provides for chain-of-custody. A Laboratory Number is assigned to the sample. The number is assigned based on the date the sample is received, the nth sample received that day, and the number of samples received. SCAQMD also requires the sample to be labeled and sealed with evidence tape.
- SCAQMD's evidence custodian generates a Sample Control Record (SCR) to be used for internal tracking of sample.
- Analyst obtains sample and completes SCR.

- A laboratory report is prepared which consists of the following elements:
  - Report of Laboratory Analysis
  - Notes from Laboratory Notebook
  - Raw Data
  - Instrument Data
  - ARCOC Form
  - SCR Form
- Sample is disposed of according to the SCAQMD's waste disposal procedures.
- Laboratory report package is archived indefinitely in both electronic and hard copy.

The second data record important to the assessment of this project includes the surveys used to document the performance of Smart Sonic's aqueous cleaning systems (Appendix F). Surveys will be completed during telephone interviews and on-site visits in indelible ink. Surveys will identify the facility and address, respondent name and telephone number, and date that survey is completed. Surveys will be filed with the project evaluation report and archived at DTSC for 3 years following the certification/verification of this project.

The third data record includes reviews conducted by DTSC's toxicologist and industrial hygienist. A work request form (Appendix I) is required for toxicologist review. Following review, the toxicologist prepares an internal memo to the requestor summarizing his/her findings. There is no specific request form for industrial hygienist (IH) review. The project manager will prepare an internal memo requesting IH review. Similar to the toxicologist review, the IH will be required to prepare an internal memo summarizing his/her findings.

B. **MEASUREMENT / DATA ACQUISITION**

1. SAMPLING PROCESS DESIGN

The Smart Sonic Certification/Verification Project incorporates two sampling designs which include:

- sampling 440-R Detergent for SCAQMD & DTSC lab analysis; and
- sampling Smart Sonic end-users for performance evaluation
  - telephone surveys
  - on-site observations and inspections

The schedule for conducting lab tests, telephone surveys, and on-site visits is shown in Figure 2. As stated in section A5, a sample of Smart Sonic's 440-R Detergent was analyzed by the SCAQMD for determination of VOHAPs, ODCs, GWCs, and VOCs. This sample was sent to SCAQMD by Mr. William Schreiber, President of Smart Sonic Corporation. Two additional samples of 440-R Detergent will be collected from end-users located within SCAQMD. The end-users will be chosen by DTSC's Project Manager and will be unknown to Smart Sonic. Samples will be transported to SCAQMD's laboratory for VOHAP, ODC, GWC, and VOC identification and to DTSC HML in southern California for metals scan and pH measurements. See the next section for specific sampling requirements.

If any VOCs or halogenated compounds are detected, the project will be stopped and results discussed with Smart Sonic for further action (see Figure 4). If metals are detected, the toxicologist will determine level of threat to public health and the environment. The project team does not anticipate any threat posed from metals. The pH measurement will be used to determine user health and safety needs.

Smart Sonic end-users will be surveyed as part of the project team's performance evaluation. (see Appendix F for survey form) The purpose of the surveys are to:

- support the cleanliness claim;
- identify range of process and operating parameters;
- document waste generation, management, and regulatory requirements;
- identify and address unforeseen performance issues; and
- qualitatively assess overall performance

Selection of end-users for telephone surveys will be based on information provided by Smart Sonic and includes:

- type of cleaning system used; and
- time cleaning system has been in operation.

Project team will focus on those end-users that have used Smart Sonic's cleaning system at a minimum of 6 months (determined from acquisition date). It is assumed that 6 months is enough time for the operator to evaluate the cleaning system's performance including cleanliness results, waste generation, maintenance, or other operational issues.

Two end-users of each system type (Model 2000, Model 4200) followed by the type of solder paste cleaned (RMA, no-clean, and OA) will be surveyed by phone. For instance, two end-users using a Model 2000 cleaning system to remove RMA solder paste from PCB stencils will be surveyed. Another two end-users using the Model 2000 cleaning system to remove no-clean solder paste will also be surveyed and so forth. This results in a total of 12 end-users to survey by telephone. The number of end-users may change because one end-user may be removing two different types of solder pastes.

Information gathered through telephone surveys will be used by the project team, including the US EPA Project Manager and Quality Assurance (QA) Officer, to select end-users for on-site observations and inspections. Selection criteria will include:

- type of cleaning system used (Model 2000 or 4200);
- type of solder paste cleaned (RMA, no-clean, water washable);
- size of stencils cleaned (if possible); and
- operator's willingness for DTSC project team visit.

At a minimum, one end-user for each system type and solder paste type will be visited by project team staff to validate Smart Sonic's cleanliness claim (see Appendix F for on-site survey form). End-users will also be selected based on the size of stencils being used. Some end-users incorporate a number of different sized stencils in their operations. The project team will select end-users so as to provide the broadest range of stencil sizes for validating the cleanliness claim.

> NOTE: The cleanliness claim will only be validated through on-site inspections by the Project team (see the next section for specific inspection requirements). Information gathered from telephone surveys regarding facility cleanliness requirements will only be used to provide additional support for the cleanliness evaluation.

2. SAMPLING METHODS REQUIREMENTS

As mentioned in the previous section, samples of 440-R Detergent will be collected from two of Smart Sonic's end-users. One Project Team member and, if needed, a SCAQMD or HML representative will be responsible for collecting the above 440-R Detergent samples. Samples will be drawn from an unopened container to ensure that no foreign contaminants have entered the detergent. Both samples will be of different batch numbers.

The Project Team member, or representative, will collect one 1000 mL sample and one 500 mL sample from one of the end-users (both samples to be collected from the same unopened 440-R Detergent container). The 500 mL sample will be sent to HML for metals analyses and the 1000 mL sample will be sent to SCAQMD for VOC analyses.

The Project Team member, or representative, will collect one 1000 mL sample, one 500 mL sample, and one 100 mL sample from a different end-user (all three samples to be collected from the same unopened 440-R Detergent container). The 500 mL sample will be sent to HML for metals analyses and the 1000 mL and 100 mL samples will be sent to SCAQMD for VOC analyses. SCAQMD will then spike the 100 mL sample with one gram each of octane, 2-butanone, toulene, and carbon tetrachloride ($\approx$1% concentration). Spiking is necessary to ensure accuracy of VOC analyses.

All samples will be stored in glass with Teflon-lined closures and placed in a cooler for transporting to the respective laboratories (note: clean and certified containers and closures will be obtained from DTSC HML in southern California).

A separate Sample Analysis Request Form (i.e., chain-of-custody form) will be completed for each sample submitted to HML and SCAQMD. Information regarding sample type, batch number, sample quantity, container size and type, and other field information will be recorded in this form. A supplemental request for spiking the 100 mL sample will also be completed and attached to the Sample Analysis Request Form submitted to SCAQMD. Upon spiking the 100 mL sample, SCAQMD will provide documentation identifying spiked compounds, quantities and sample concentrations.

The following are laboratory addresses and contacts.

a. SCAQMD Laboratory Services
21865 E. Copley Drive
Diamond Bar, California 91765-4182
Contact: Mr. Rudy Eden, Senior Manager
Phone: (909) 396-2391
Fax: (909) 396-2099

b. DTSC HML
1449 West Temple Street, Room 101
Los Angeles, California 90026
Contact: Ms. Janice Wakakuwa
Phone: (213) 580-5796
Fax: (213) 580-5706

NOTE: Preservation requirements are not specified by the US EPA for this type of detergent matrix.

As mentioned in the previous section, the project team will conduct on-site inspections to validate the cleanliness claim. Two members of the project team will observe the stencil cleaning operation. Each project team member will then inspect every aperture of the cleaned stencil using a 10X magnification eye-piece. Appropriate lighting on back side of stencil shall be used for inspection. One project team member will record findings in the on-site survey form in Appendix F.

3. SAMPLE CUSTODY REQUIREMENTS

The SCAQMD and DTSC have established procedures for maintaining the control and integrity of samples from collection, preservation, transportation, laboratory services, storage, and disposal. DTSC's and SCAQMD's laboratory sample control procedures are identified in Appendix G and H respectively. In both laboratory procedures, a sample analysis request (SAR) is required upon submittal of the sample to the laboratories. The SAR also includes the sample chain-of-custody record. Once the SAR is received, a sample control number is assigned to the sample.

SCAQMD's sample control number is assigned based on the date the sample is received, the nth sample received that day, and the number of samples received. For example, the control number 92597-02-001 would indicate that on September 25, 1997, SCAQMD received one sample from Smart Sonic which was the second aqueous cleaner sample received that day.

DTSC assigns an authorization number (AN) prior to receiving a sample for analysis. The AN is assigned based on designated laboratory, fiscal year, and the number of requests to date. For example, the control number SCN 2000 would indicate that DTSC's HML in southern California is the designated laboratory to receive the sample, the sample is received in the 1997-1998 fiscal year (designated by "N"), and that this is the 2000th sample received to date. Once a sample is received at the laboratory, DTSC-SC will assign a sample number which is based on the sequential number of samples received. DTSC-SC uses a 3-digit sequential numbering system prefixed by the number 16 (ie., 16001).

4. ANALYTICAL METHODS REQUIREMENTS

Table 2 identifies the laboratory test methods to be used in analyzing Smart Sonic's 440-R Detergent. A description of SCAQMD's Test Method 313 and the targeted compounds are found in Appendix C.

NOTE: In analyzing Smart Sonic's 440-R Detergent using SCAQMD's Test Method 313, SCAQMD will inject 1 μl of liquid 440-R Detergent into GC column using isooctane as solvent flush. All other procedures in this test method are explained in Appendix C.

Table 2. Project Laboratory Test Methods

Laboratory	Test Method	Target Compound(s)
SCAQMD	**313 (GCMS)**	**VOCs, VOHAPs, GWCs, ODCs**
DTSC-S.California	**EPA Test Method 6010**	**Ag, As, Ba, Be, Cd, Co, Cu, Mo, Ni, Pb, Sb, Se, Tl, V, Zn**
	EPA Test Method 7470	**Hg**
	EPA Test Method 9040	**pH measurement**

5. QUALITY CONTROL REQUIREMENTS

DTSC HML's quality control practices are outlined in Appendix G. SCAQMD's quality control practices are outlined in both Appendix C (Test Method 313) and H (Sample Control). The following is a brief list of QC practices used by the SCAQMD laboratory in its VOC analysis:

- multilevel calibration using standards consisting of approximately 27 compounds;
- isooctane solvent blank to ensure absence of contaminants in GC column;
- analysis of duplicate laboratory samples; and
- preparation of new standards and recalibration if any components are observed on the GC which are not included the original calibration standards.

One additional QC requirement requested of SCAQMD is to ensure the accuracy of its laboratory data. SCAQMD will determine accuracy from the analysis of the 100 mL spiked sample. Spiked sample accuracy, as percent recovery, should not exceed ±25% of spiked value. Percent recovery (R) is defined as:

$$R = \frac{C - X}{T} (100)$$

where C is the measured spike sample value
X is the unspiked sample value
T is the value of spike added

If actual recovery exceeds ±25% of spiked value, the project team, US EPA Project Manager, and US EPA Quality Assurance (QA) Officer will discuss results and determine further action. All other sampling and data quality requirements remain in effect.

6. INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Any change-out of instrumentation will be documented in maintenance log or chemist/analyst log and a copy provided in the laboratory report.

7. INSTRUMENT CALIBRATION AND FREQUENCY

DTSC HML's instrument calibration for inorganic analysis is shown in Appendix G. SCAQMD laboratory's instrument calibrations are shown in Appendix C.

8. DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

There are three types of data that will be acquired from non-direct measurements:

- telephone surveys;
- 440-R Detergent ingredients list supplied by Smart Sonic; and
- material safety data sheets (MSDS) supplied by Smart Sonic.

Telephone surveys will be conducted independent of Smart Sonic's knowledge. There are no defined acceptance criteria for end-user responses and all responses to surveys will be documented and a qualitative assessment will be conducted by the project team for inclusion into the Evaluation Report. Responses which merit further evaluation will be investigated for validity. Responses to waste generation and management questions may be validated, if possible, by project team through hazardous waste databases such as TRI, Biennial Generator Reports, or DTSC's manifest database.

440-R Detergent ingredients list and MSDSs will be provided by Smart Sonic. MSDSs will be used for DTSC toxicology review. There are no defined acceptance criteria for ingredients list or MSDSs.

9. DATA MANAGEMENT

All records used in sample collection, packaging, transportation, chain-of-custody, lab analysis and sample control, to final reporting will be filed with the appropriate laboratory and copies with DTSC's Project Manager (see Appendix G and H for sample and data control). The laboratories will keep all records in both electronic and hard copy format.

Final reports from DTSC Toxicologist and Industrial Hygienist review will be filed in original hard copy format with DTSC's Project Manager. DTSC Toxicologist and Industrial Hygienist will retain a hard copy and an electronic version of their reports. Reports will include all supporting data and description of analysis methods.

All surveys (both telephone and on-site) will be filed with DTSC's Project Manager in original hard-copy format.

Reports generated by DTSC's Project Manager will be kept with the Project Manager in both hard and electronic format. Electronic reports will by copied to diskette for back-up and filed with DTSC's Assignment Manager.

All reports and data generated from this project will be centrally filed with OPPTD at a minimum of 3 years following certification/verification. At this time, DTSC's Assignment Manager will have the authority to transport the report and supporting data to State Archives.

C. **ASSESSMENT / OVERSIGHT**

During implementation of the workplan, Figure 3, DTSC's Project Manager will provide a weekly update to DTSC's Assignment Manager. The US EPA Project Manager and Smart Sonic will be updated biweekly on the project's status, either by telephone or e-mail. DTSC's Project Manager will frequently interface with the Project Team's QA/QC member on data collection procedures, data quality, and data analysis.

Following each major task, DTSC's Project Manager will prepare a "Summary of Findings". A copy of the Summary will be forwarded to each Project Team Member, Assignment Manager, and US EPA Project Manager and Quality Assurance (QA) Officer for review and comments. Currently, procedures for conducting a qualitative assessment of survey data are not established for this project. To reach consensus on this assessment, the project team and the US EPA Project Manager and QA Officer will work jointly in developing the "Summary of Survey Findings".

Following completion of the Workplan, the "Summary of Findings" will be combined into a Draft Evaluation Report. DTSC's Project Manager will provide a copy of the Draft Evaluation Report to the Project Team members, US EPA Project Manager and QA Officer, and Smart Sonic. DTSC's Project Manager will then conduct a project review meeting to discuss the final results of the project and draft a certification/verification decision. If inadequacies in the data are noted at this time, the Draft Evaluation Report will note these inadequacies and offer: 1) recommendations for additional field tests; 2) suggested language reducing the scope of the certification/verification; and/or 3) proposed language for negative certification/verification decisions. The Draft Evaluation Report is then forwarded to the Technical Review Panel.

D. **DATA VALIDATION AND USABILITY**

1. DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

The sampling design is outlined in section B2. No deviations from the sampling design are anticipated. However, if any of the following conditions occur, then the sample laboratory analysis will be void:

- sample was collected from a previously opened container;
- sample contamination occurred;
- QA/QC procedures were not followed; or
- it became known that Smart Sonic was aware of sampling site.

Sample preservation, analytical methods, and data integrity will be validated by laboratory chemist, analyst, and supervisor and documented in the laboratory data package.

Data generated through surveys will be validated, if available, by DTSC's project manager in a number of ways:

- on-site facility observations and inspections;
- review of facility's operations and inspection procedures;
- review of invoices for purchase of solder paste(s);
- conversations with solder paste and stencil vendors;
- review of facility waste generation and management records or manifests; and
- review of facility's waste analysis documentation.

2. VALIDATION AND VERIFICATION METHODS

Validation and verification will be conducted by several members of the Project Team and at different stages of the project. Validation and verification are defined for this project as follows:

Validation - examining results of analytical tests and surveys to determine if data supports applicant's claims.

Verification - confirming that procedures and activities outlined in the project workplan were followed in generating data.

The project team will verify and validate the procedures and data generated by SCAQMD's Laboratory. Cindy Dingman from DTSC Hazardous Materials Laboratory [(510) 540-2329] will verify and validate the procedures and data generated by DTSC's Hazardous Materials Laboratory (Appendix G discusses some key indicators that DTSC considers when determining validity of data). Bruce Labelle from the Project Team will provide qualitative review of survey results to ensure that data can support the project evaluation.

3. RECONCILIATION WITH DATA QUALITY OBJECTIVES

SCAQMD lab results will be used to determine if any VOCs or halogenated compounds are detected above 100 ppm. If VOCs or halogenated compounds are detected, the results will be discussed with Smart Sonic and a decision will be made to either modify the claims or to discontinue the project.

DTSC's laboratory metals analysis will be used for toxicology review to determine if a potential threat to public health or the environment exists. If the toxicology review of laboratory data or MSDSs indicates a threat to public health and the environment, the results will be discussed with Smart Sonic and a decision will be made as to whether to continue with the project. Project team does not anticipate any threats to public health and the environment.

The results of DTSC's Industrial Hygienist review will identify any health and safety issues that may arise from use of Smart Sonic's cleaning systems. Any health and safety issues, if identified, will be discussed with Smart Sonic. DTSC's Industrial Hygienist, Project Manager, and Smart Sonic will discuss measures (i.e., engineering or administrative controls) to prevent potential hazards to workers. This may include operator training or revision of User's Manual to address the health and safety issues.

Results of on-site observations and inspections will validate Smart Sonic's cleanliness claim. If a 10X cleanliness inspection fails, findings will be discussed with Smart Sonic and a decision will be made to either modify the claim or to discontinue the project.

Appendix A

Literature on Smart Sonic PCB Stencil Cleaning Systems

Appendix B

Draft Claims for Smart Sonic Certification/Verification Project

Appendix C

SCAQMD Clean Air Solvent Protocols

Appendix D

SCAQMD Analysis of Smart Sonic's 440-R Detergent

Appendix E

Information on Mercury in Caustic Soda

Appendix F

Telephone and On-site Survey Forms

Appendix G

DTSC’s Laboratory Quality Control Practices

Appendix H

SCAQMD’s Sample Quality Control Practices

Appendix I

Work Request for Toxicologist Review